

ON *DISTOMUM VIBEX* LINTON, WITH SPECIAL REFER-
ENCE TO ITS SYSTEMATIC POSITION

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Distomum vibex was described by Linton (1900, 1901, 1905), from the pharynx and intestine of the smooth puffer, *Spheroides maculatus*. For many years this species has been studied as the representative of digenetic trematodes by the classes in Invertebrate Zoölogy at the Marine Biological Laboratory of Woods Hole. Since the early and brief reports of Linton, little or no research has been done on the parasite. The purpose of this study is, therefore, to supplement the earlier descriptions of its morphology and to allocate the species in the system of classification of the digenetic trematodes.

LINTONIUM NEW GENUS

Distomum Diesing 1850 is the equivalent of *Distoma* Retzius 1782, a name proposed as a substitute for *Fasciola* Linnaeus 1758—and consequently a synonym. Looss (1899) showed that *Distomum* is not a generic but a group name, and with the subdivision and disappearance of the previously accepted genus *Distomum*, the proper generic name and systematic position of *D. vibex* has remained an open question. Since *Distomum* is not a valid generic name, and since the species can not be assigned to any existing genus, we propose the new genus *Lintonium* to contain it.

The distribution of *Lintonium vibex*, so far as has been determined, appears to be limited to the species *Spheroides maculatus*, commonly found off the coasts of New Jersey and New York and as far north as Maine. Primarily, however, the members of the group of "swell-fishes" are inhabitants of warmer waters, and the relatives of *Lintonium vibex* are presumably to be found, if at all, in species of *Spheroides* which inhabit warmer seas. According to Linton, the largest worms are found in the pharynx, attached to the walls around the entrance to the pouch. Young specimens, however, were encountered in the intestine.

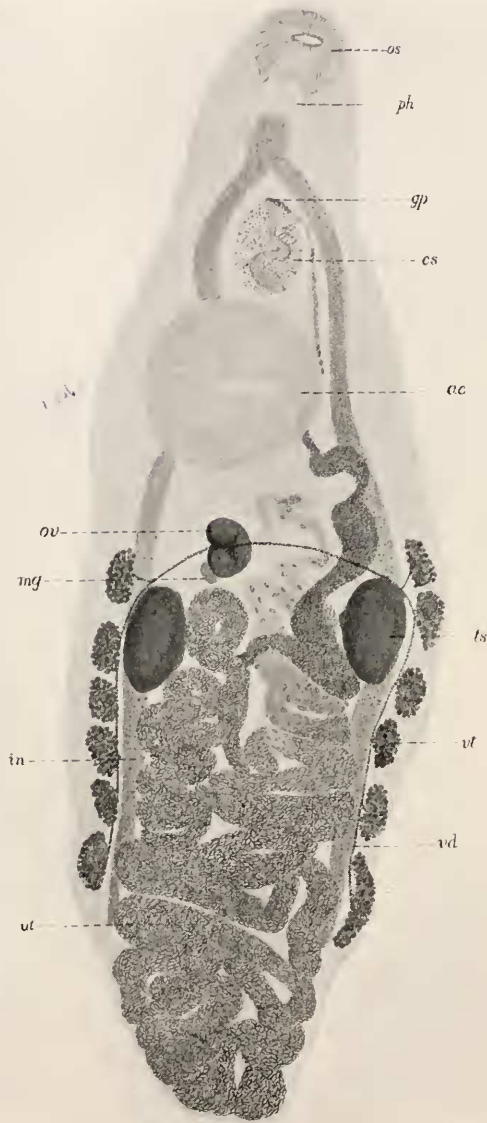
Except for certain details, which appear in the text, our observations agree with those of Linton. The parasites are so variable in size and form that precise measurements are difficult to make. Fixed

and stained sexually mature specimens vary from 2 to 7 mm. in length, 0.7 to 2 mm. in width, and 0.266 to 0.912 mm. in thickness. In living worms, the region anterior to the acetabulum is very mobile and may be elongated into a neck-like structure, one and one-half times the length of the body posterior to the ventral sucker. In fixed specimens the acetabulum is located at the posterior end of the anterior third of the body. It is considerably larger than the oral sucker, oval to spherical in shape, and measures from 0.4 to 1.3 mm. in diameter. The suckers are powerful adhesive organs and the parasites are removed from their attachments only with difficulty.

The body wall is strongly developed and the specimens are very muscular. The cuticular covering measures from 0.021 to 0.032 mm. in thickness and is much heavier on the dorsal than on the ventral surface. When the worm is contracted the cuticula is thrown into convolutions that give it a "ringed" appearance, although it is not provided with either scales or spines. The muscular layers of the body wall consist of an external circular, an intermediate longitudinal, and an internal oblique layer of fibers. In the anterior part of the body especially, the parenchyma is traversed by well-developed fibers. These are not arranged in definite layers and have branched or diffuse origins and attachments. Immediately below the muscular wall there are many glandular cells which probably secrete the cuticula. Inside the nuclear zone, on the ventral side of the body, there is a well-developed series of longitudinal muscles that extend from the body wall in the region behind the genital pore to the region of the acetabulum, and others that extend on the region of the oötype.

The mouth opening is subterminal and the oral sucker, spherical to oval in shape, measures from 0.23 to 0.57 mm. in diameter. The pharynx, situated immediately behind the oral sucker, measures from 0.10 to 0.19 mm. in diameter. Following the pharynx there is an apparent esophagus of varying width and diameter. Histologically, however, this structure resembles the digestive ceca; it is lined with epithelium and should properly be regarded as a portion of the intestine. Two simple intestinal crura pass posteriorly in the dorsal and lateral regions of the body, terminating blindly about the middle of the posterior third of the worm.

The excretory pore is situated at the posterior tip of the body. It opens from a small vesicle which is lined with cuticula. From the vesicle two collecting tubes pass forward, dorsal and median to the intestinal ceca to the level of the acetabulum where they cross to the extracecal region and continue to the level of the pharynx. The collecting vessels are variable in shape and size and the walls consist of



Lintonium vibex, ventral view $\times 40$. *ac*, acetabulum; *cs*, cirrus sac; *gp*, genital pore; *in*, intestine; *mg*, Mehlis' gland; *os*, oral sucker; *ov*, ovary; *ph*, pharynx; *ts*, testis; *vt*, uterus; *vd*, vitelline duct; *vt*, vitellaria.

a basement membrane bearing a layer of flattened epithelial cells. Further details of the system have not been worked out.

The testes are lateral, situated just behind the middle of the body. Oval in shape, with their longest axis directed anteroposteriorly, they measure from 0.15 by 0.22 mm. in small worms to 0.6 by 0.8 mm. in the largest ones. From the anterior tip of each a vas deferens passes forward on the dorsal side of the body and empties into the seminal vesicle located in the caudal end of the cirrus sac. The cirrus sac is situated on the dorsal side of the body in the region between the bifurcation of the alimentary tract and the anterior border of the acetabulum. The sac has a well-developed fibromuscular wall, containing both circular and longitudinal muscle fibers, and measures about 0.35 mm. in length by 0.22 mm. in width. The seminal vesicle is somewhat coiled, and in some whole mounts gives the appearance of being composed of two parts: a small, oval, caudal portion and a much larger anterior portion. From the vesicle a narrow duct, 0.06 to 0.07 mm. in diameter, leads to the common genital pore. This duct is usually S-shaped and is lined with columnar epithelium. Both vesicle and duct are surrounded by prostate cells.

It is interesting to note that in one instance, a worm was found with a single testis and vas deferens. Otherwise the specimen appeared to be perfectly normal.

The ovary is trilobed; it consists of one large dorsal and two smaller ventral lobes. It is situated on the dorsal side of the body, at the right of the median plane, in front of the testes, and behind the acetabulum. It is slightly longer than broad, measuring from 0.15 to 0.54 mm. in length and from 0.15 to 0.43 mm. in width. The oviduct arises at the posterior tip of the dorsal lobe and just after entering the oötype, gives off Laurer's canal. Laurer's canal passes forward in a winding course and opens to the dorsal surface above the anterior margin of the ovary. It traverses a distance of approximately 0.2 mm., measures about 0.015 mm. in diameter, and is lined with cuticula. After the origin of Laurer's canal, the female duct passes posteriad and ventrad where it receives a common vitelline duct and then turns dorsad and anteriad, to open into the uterus. There is no seminal receptacle. The oötype is enclosed in the cells of Mehlis' gland, which lies posterior and ventral to the ovary. From the oötype the uterus extends laterally and forward. This portion is filled with sperm and light-colored eggs with deeply staining contents. The vitellaria consist of six lobes on each side of the body. They lie in the extracecal area, from the level of the ovary to the caudal ends of the intestinal ceca. Collecting ducts pass forward along the medial face of the five caudal lobes and bend mediad in front of the testes. The cephalic lobes have their own ducts, which

discharge into the main longitudinal ducts as they turn mediad. These ducts meet in the median line to form a common vitelline duct that passes through Mehlis' gland to empty into the oötype. No vitelline receptacle was observed. The uterus passes backward on the left side of the body to the caudal end and then forward, and fills the intercecal area behind the ovary with masses of complicated coils. In front of the ovary the uterus continues in the dorsal portion of the body to the genital pore, situated immediately behind the bifurcation of the alimentary tract. The metraterm is short, and there is a small genital sinus into which the male and female ducts open.

The uterus is filled with enormous numbers of eggs. They are ovate in shape, with an operculum at the narrow end of the shell. They measure from 0.045 to 0.054 mm. in length by 0.023 to 0.027 mm. in width.

From the above description the genus *Lintonium* may be characterized as follows: small to medium sized distomes; suckers powerful, acetabulum larger than the oral sucker; strongly muscular bodies, preacetabular region especially mobile; esophagus short or absent, pseudo-esophagus short, lined with digestive epithelium; intestinal ceca extend posterior to the testes; excretory vesicle almost V-shaped with short stem, lateral crura extend to the region of the pharynx; genital pore ventral, immediately behind the bifurcation of the alimentary tract; cirrus sac oval, preacetabular, enclosing seminal vesicle and cirrus; testes lateral, postovarian; ovary postacetabular, lateral and pretesticular; uterine coils extend to posterior end of body, filling the intercecal area behind the oötype; eggs ovate, operculum at the smaller end; vitellaria lateral, postovarian.

In morphological features *Lintonium* agrees more closely with *Steringotrema* Odhner 1911 than with any other known genus.¹ The genus *Steringotrema* was proposed to contain a species described by Nicoll (1909) as *Steringophorus cluthensis*, since the form could not properly be retained in the genus *Steringophorus* because of differences, especially in the form of the excretory vesicle. *Lintonium* differs from *Steringotrema* in several distinct morphological features. The acetabulum, ovary, and testes are much farther forward, and there are differences in the form and location of the vitellaria.

Odhner (1911) proposed a new family, Steringophoridae, with two subfamilies, Steringophorinae and Haplocladinae. In the former he included *Steringophorus* Odhner 1905, *Fellodistomum* Stafford 1904, and the two new genera, *Rhodotrema* and *Steringotrema*. It should be noted, however, that Nicoll (1909) had erected the subfamily Fellodis-

¹ According to Odhner, 1928 (Arkiv. f. Zoologi, Vol. 20), *Steringotrema pulchrum* S. J. Johnston 1913 is identical with *Gastris consors* Lühe 1906.

tominae to include *Fellodistomum* and *Stringophorus*. Consequently, since the two groups are co-extensive, the proposal of the subfamily *Stringophorinae* was a deliberate renaming of a previously validly named subfamily. Odlner's reasons for changing the name are stated as follows: "Wenn ich für diese Unterfamilie den von Nicoll (1909, S. 472) vorgeschlagenen Namen *Fellodistominae* verwenden würde, müsste ich die ganze Familie *Fellodistomidae* nennen, was mir bei dem Umstande, dass nur ein einziger Vertreter derselben mit der Galle etwas zu tun hat, allzu sinnlos erscheint. In *Stringophorus* erblicke ich weiter diejenige Gattung, welche den Typus der ganzen Familie am reinsten verkörpert; während die typische Art der Gattung *Fellodistomum*, *F. fellis*, entschieden als der am wenigsten typische Vertreter der ganzen Unterfamilie bezeichnet werden darf. Aus diesen Gründen erscheint es mir als richtig, den Namen *Fellodistominae* beiseite zu schieben, und ich trage hierbei um so weniger Bedenken da sich dieser Name als erst jüngst geschaffen noch nicht weiter eingebürgert hat."

Commenting on Odlner's action, Woodcock (1912) stated that, ". . . this change in name appears to contravene the usually accepted rules," and referring to the family name this author observed that ". . . the name should be *Fellodistomidae* as the author (Odlner) himself recognizes." Nicoll (1913) further stated, "It is obvious that the name *Stringophorinae* cannot stand but must give place to the earlier *Fellodistominae*. The name of the family should consequently be changed to *Fellodistomidae*." In a later paper, Nicoll (1915) used the family name *Fellodistomidae* without comment.

Poche (1925) attempted to justify Odlner's change of name but his argument appears to be beside the point as will be shown later. Fuhrmann (1928) adopted Odlner's classification and in the subfamily *Stringophorinae* included *Stringophorus* Odlner, *Fellodistomum* Stafford, *Rhodotrema* Odlner, *Stringotrema* Odlner (syn. *Pycnadena* Linton), *Didymorchis* Linton, and *Bacciger* Nicoll. It should be pointed out that *Didymorchis* Linton 1910 was preoccupied, and the following year Linton (1911) proposed the name *Pycnadena* for it. There appear to be too many differences between *Stringotrema* and *Pycnadena* to regard them as identical, and Fuhrmann's statement of synonymy is probably an error.

It will be noted that in Odlner's arrangement, *Stringophorus* is named not only as type of the subfamily but of the family as well and that *Stringophorinae* is designated as type subfamily. Poche based his argument on the provision in the rules of nomenclature that the name of a family or subfamily is to be changed when the name of the type genus is changed. It is obvious, however, that the name of the type

genus of Nicoll's subfamily Fellodistominæ was not changed in Odlner's arrangement. Instead, another genus was selected as type. The opinion of Professor Ch. W. Stiles was asked concerning the status of Odlner's action and the validity of the subfamily name Steringophorinæ. In a personal communication he makes the following statement, "Steringophorinæ is a deliberate renaming of the subfamily Fellodistominæ.

"On page 98, Odlner gives a footnote in which he explains why he renamed the subfamily. His explanation shows that he confused two elements, namely, the genus which forms the nomenclatorial type and the genus which he looked upon as the anatomical norm. This is not an uncommon confusing which occurs in systematic zoölogy and is due to the fact that the word "type" is used in so many different senses. According to Odlner, Fellodistomum, the nomenclatorial type of Fellodistominæ, represents a peripheral genus from his point of view, while Steringophorus represents the anatomical norm. This, of course, is a point of view, but in the last analysis, is somewhat subjective and may be changed by a division of the subfamily by some future author.

"The important point is that Fellodistomum is the nomenclatorial type of the first available subfamily name.

"If Odlner's method of nomenclature were applied generally to zoölogy, there would be numerous unnecessary changes in family and subfamily names. On basis of Odlner's statements, Steringophorinæ is subjective synonym of Fellodistominæ. It is subjective rather than objective because it has a different type genus. I would not hesitate an instant in this case, I would use Fellodistominæ."

The analysis and decision of Professor Stiles is so incisive and pertinent that its publication is a valuable contribution to zoölogical literature. It outlines correct procedure and stands in contrast to the confused and irrelevant argument of Poche. Since Fellodistominæ is accepted as the type subfamily of the family to which it belongs, the family name must be Fellodistomidæ. So far as has been determined, the subfamily includes the following genera: *Fellodistomum* Stafford 1904, *Steringophorus* Odlner 1905, *Pycnadena* Linton 1911, *Rhodotrema* Odlner 1911, *Steringotrema* Odlner 1911, *Bacciger* Nicoll 1914, and *Lintonium*, gen. nov.

SUMMARY

Additions are made to the description of *Distomum vibex* Linton. Since *Distomum* is not a valid generic name, and since the species cannot be assigned to any known genus, the new genus *Lintonium* is erected to contain it. The genus belongs to the subfamily Fellodistominæ, Family Fellodistomidæ (Syn. Steringophoridae).

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